CLAIMS

1. A process for treating a polluted liquid having at least one contaminant in intimate mixed relation therein, including the steps of passing the polluted liquid under pressure through a cross-flow filter module having a filter with a series of lumens having filter membranes extending substantially parallel with the flow of said polluted liquid; maintaining the flow at a predetermined minimum velocity to substantially sustain scouring of the surface of said membrane by said liquid; maintaining said pressure to induce passage of said liquid as a permeate in a substantially unpolluted, filtered condition through said filter membrane into a permeate space, wherein the concentration of said contaminant in said polluted liquid is progressively increased; applying a pressure back-pulse to said filtered liquid in said permeate space to reverse flow through said filter membrane, in at least partial cleaning relation therewith, and collecting said polluted liquid and said filtered liquid for disposal.

2. The process as set forth in Claim 1, including the step of introducing a cleaning solution in place of said permeate liquid; and back-flushing said filter membrane with said solution to at least partially remove a said contaminant therefrom.

3. The process as set forth in Claim 2, including draining said cleaning solution from said module; and continuing to pass said polluted liquid through said module.

4. The process as set forth in Claim 1, including back-flushing said permeate to substantially cover said membrane, prior to applying said pressure to said polluted liquid.

5. The process as set forth in Claim 2, including the step of heating said cleaning solution, to promote the effectiveness thereof.

6. The process as set forth in Claim 5, including the step of recirculating said contaminated liquid in a closed circuit, to raise the temperature thereof, whereby the temperature of said module and said cleaning solution are raised, to promote the cleaning action of said cleaning

solution.

7. The process as set forth in Claim 2, wherein said polluted liquid is water and said contaminant is oil, said cleaning solution being selected from the group consisting of citric acid, nitric acid, non-caustic alkaline low-foam metal cleaning detergent, hydrogen peroxide, sodium hydroxide, and mutually compatible combinations thereof.

8. The process as set forth in Claim 2, said cleaning solution being a mixture of a plurality of mutually compatible cleaning solutions.

9. The process as set forth in Claim 2, wherein said filter module is operated cyclically, with a period when said polluted liquid is circulated through said module and said permeate is removed from the module being followed by a period when at least one said cleaning solution is applied to said filter in situ, in cleaning relation therewith.

10. The process as set forth in Claim 9, wherein said process is automatically cycled to include periods of filtration activity, periods of cleaning, and quiescent periods, said periods being programmed to provide a desired rate of filtering operation.

11. The process as set forth in Claim 2, wherein said permeate space is minimized, to effectively minimize the quantity of said cleaning solution required to fill said permeate space, whereby said step of introducing said cleaning solution may be repeatedly and economically applied.

12. Apparatus for retrieving re-usable water from an intimate water/oil - contaminated mixture, said apparatus having a cross-flow filter module to permit the passage of substantially oil-free water as a permeate through the filter module; pumping means to circulate said contaminated mixture through said module at a predetermined flow rate sufficient to substantially resist deposition of contaminants and to scour a surface membrane portion of said filter module; and permeate accumulation and drain means to receive said permeate for disposal,

wherein, in use the concentration of oil within said contaminated mixture is progressively increased to a predetermined optimum practical limit.

13. The apparatus as set forth in Claim 12, including cleaning solution storage means, manifold means interconnecting elements of said apparatus; and control means including solenoid actuated valves connected with said apparatus elements and said manifold means, in use to drain said permeate from said module, and to admit cleaning solution from said storage means to said module in back-flushing relation with said surface membrane portion of the module.

14. The apparatus as set forth in Claim 12, said filter module having a central tube incorporating said surface membrane portion, an outer housing in radially spaced relation from said tube, forming an annular space therebetween, sealing ring means located adjacent the ends of said central tube in interposed sealing, supporting relation between said tube and said pipe, and an end fitting secured in sealing relation with the end of said housing to enable the flow of said contaminated mixture through said end fitting and into said tube.

15. The apparatus as set forth in Claim 14, said sealing ring means at each end of said tube having two O-ring seals in mutual axially spaced relation.

16. The apparatus as set forth in claim 12, including compressed air means connected to said permeate accumulation means, and control means to admit compressed air in compressing relation with said permeate, in use to create a back-flushing motion of said permeate through said filter surface membrane.

17. The apparatus as set forth in Claim 13, wherein said apparatus is mounted within a cabinet, including computerized control means in programmed controlling relation with the apparatus.

18. The apparatus as set forth in Claim 17, wherein said cabinet contains two said processing loops mounted in back-to-back relation, and pivot means enabling the reversal of said modules,

to facilitate access thereto for purposes of servicing.

19. The apparatus as set forth in Claim 17, said computerized control means serving a plurality of said filter modules in individual liquid filtering and filter cleaning modes of operation of the apparatus.

20. The apparatus as set forth in Claim 12, said permeate accumulation means having a substantially minimal volume, to minimize the volume of cleaning liquid required to fill said permeate accumulation means, for purposes of cleaning said filter module by back-flushing with said cleaning liquid.